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MYCOLOGICAL EXPEDITION TO GUATEMALA.*

W. A. KELLERMAN.

During the winter months of January, February and March, 1905, a botanical trip was made to Guatemala, Central America, for the purpose of collecting parasitic fungi. A trip for like purpose was again made in the corresponding months of 1906. A large amount of material was collected for study, the results of which may appear from time to time in future Nos. of the JOURNAL. The itinerary only will be given in this article, with some account of the general botanical character of the regions visited. Later, notes will be published on the fungi, and some of the more interesting, as well as rare or new species, will be illustrated by a distribution of selected exsiccata.

GENERAL TOPOGRAPHY.

Guatemala is situated between 13.8 and 17.8 degrees north latitude, and 88.3 and 92.2 degrees longitude west of Greenwich. It embraces an area of 60,000 square miles, being bounded on the north by Mexico, Yucatan and Belize (or British Honduras); on the East by Belize, Bay of Honduras and Spanish Honduras; on the South by Honduras, San Salvador and the Pacific Ocean; and on the West by the Pacific Ocean and Mexico. The entire country is of volcanic origin, a large portion being mountainous. The Cordilleras, considered a continuation and connecting range of the Rocky Mountains and of the Andes, traverse the region in a northwesterly and southeasterly direction, the crest being 50 miles from the Pacific Ocean. The altitude is about 8,000 feet in the West or Northwest to about 5,000 or 4,000 at the Southern boundary line of the Republic. The numerous volcanoes are of course much higher, reaching in many cases an altitude of 11,000 to 12,000 feet. From this range of the Cordilleras there is a very considerable extension of the mountain chain eastward to the Bay of Honduras; the height is about 3,000 feet, but considerably less as it approaches the eastern coast of the country. Here it is conspicuous by reason of a comparatively lofty peak (called San Gil), probably an extinct volcano (but as yet unexplored) that rises to a height of at least 1,500 feet. The chain just mentioned is called the Sierra de las Minas; the extreme eastern portion however is called Sierra del Mico. The portion of the country bordering on Honduras is also mountainous, but no considerable altitude is anywhere attained; several extinct small volcanoes occur here.

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* Contributions to Guatemalan Mycology. I.

The land near the coast is low — the low area on the Pacific side being rather narrow, then gradually ascending so that at a distance of 30 or 40 miles the altitude is 1,000 feet. From that line the slope is very steep to the general crest of the Cordilleras. On the Atlantic side the low land is much more extensive. A great tropical swamp lies back to Puerto Barrios. An altitude of 500 feet would not be reached up the valley of the Motagua, or Rio Grande, short of 1000 miles from the coast. Following westward from the mouth of the Rio Dulce an altitude of 500 feet would be attained when Lake Izabal was passed — and a point reached perhaps 80 miles from the Bay of Honduras. Then the country (in the Department of Alta Verapaz) becomes mountainous. An exceedingly interesting topographical region is the extreme northern section, this Department being called El Petén. It is not mountainous; it has the general character of Yucatan. But there are great rivers and many lakes in Petén. The country has not been thoroughly traversed by explorers and is practically a terra incognita. The itinerary neither year included this enticing region though it is hoped that in the near future its mycological flora may be subjected to some scrutiny. Before passing in review the particular places visited, and sketching their general features in order to elucidate to some extent the character and distribution of the fungi that subsequent notes may disclose, a few words on the climatology and hydrography will be given — these being supreme factors determining the character and distribution of the vegetation.

CLIMATE.

While it is a tropical climate the varying altitudes afford considerable variation in temperature — this being more pronounced than the variation from season to season (Winter to Summer) in any given locality. As to the latter, it may be said that the Winter temperature is but slightly below that of the Summer months — perhaps 10 or 12 degrees. The daily range is not great — the nights however being quite cool — invariably 10 (or even 20) degrees or more below that of noonday. Near the coast the temperature is often about 90 degrees Fahrenheit. At an altitude of 5,000 feet 70 to 80 degrees may be considered a fair estimate for midday temperatures. At 8,000 feet, the highest point for which records are available, Quezaltenango, the temperature is much lower. The monthly extremes as recorded by Rev. W. E. McBath, of that city, are given below. A self recording instrument was used and the readings for the year 1905 were as follows, — the highest and lowest record for morning and for evening being shown:

January,	A. M.,	26	and	49;	P. M.,	55	and	70°	F.
February,	"	30	"	49;	"	61	"	73°	"
March,	"	29	"	54;	"	70	"	79°	"
April,	"	41	"	56;	"	70	"	80°	"
May,	"	45	"	57;	"	70	"	78°	"
June,	"	47	"	56;	"	65	"	77°	"
July,	"	42	"	55;	"	62	"	74°	"
August,	"	42	"	55;	"	65	"	75°	"
September,	"	43	"	55;	"	63	"	75°	"
October,	"	38	"	56;	"	62	"	73°	"
November,	"	38	"	54;	"	66	"	72°	"
December,	"	29	"	49;	"	63	"	69°	"

While no records can be given for the very high volcanoes, it can be stated that no freezing temperatures were exprienced though the cold seemed very severe. No snow was seen during the winters of 1905 and '6. There is no snow line in the Republic of Guatemala, but the inhabitants state that at rare times snow is seen on the highest mountains.

HYDROGRAPHY.

Throughout the country there is an alternation of a rainy and a dry season. Abundant precipitation usually begins in May and ceases in October; the months between October and May constitute the dry season at which time no rains fall except in the low country near the coast and in the Department of Alta Verapaz. In the latter regions rains are common throughout the year but the precipitation is comparatively slight during the so-called dry season. Clouds are formed continuously in the highest mountain regions and especially about the cones of the volcanoes, but the rainfall does not seem to be excessive at these altitudes. There is an arid region supporting a purely xerophytic vegetation, in the central portion of the country, beginning at Gualan, 80 miles from Puerto Barrios, in the valley of the Motagua, extending to El Rancho 130 miles from the Port just named; thence westward and northwestward through Salamâ, in the Department of Baja Verapaz. Tree Cacti of the *Cereus Opuntia* and *Peireskia* types, and spinous *Leguminosae* are the characteristic forms. The grass and other vegetation seems to be absolutely dead during the dry season yet when the rains begin in the Spring everything becomes suddenly and intensely green, as if by magic. Here however the rainfall is less than in any other part of the Republic. This sharply marked seasonal change from extreme wet to extreme dry — each of the two seasons about the same length — accounts for the pronounced xerophytic aspect of the vegetation. The low-lying countries and the high peaks or crests of the mountains have however the usual character of moist tropical countries. Two of the mountain lakes are of considerable size; the largest Lake Atitlán, in the Department of Sololá, is about 8 or 10 miles in length and nearly as broad; it has a depth of 1,000 feet; there is no known outlet.

Lake Amatitlán, situated in the Department of Amatitlán, is about 7 or 8 miles long but only one to 3 miles wide; it is 75 to 100 feet deep, and is drained by the Rio Michatoya. The shore vegetation and that of the mountains forming the steep-sloping walls is strongly xerophytic in character. Some of the craters of the numerous extinct volcanoes are occupied by little lakes. Only two very large rivers, but with rather narrow valleys, drain the eastern side of the Republic — these being the Rio Grande, but usually called the Motagua, south of the Sierra de las Minas, and the Rio Dulce, called the Polochic above Lake Izabal, north of this mountain range. The Chixoy, further north called the Usumacinta, in the central part of the country, flows northward into Mexico. The rivers on the Pacific side are very numerous and need not be individually mentioned. For a correct account of the climate, rainfall, lakes and rivers of the Department of El Petén no sufficient data are at hand — besides, no mycological collections have as yet been made in that region.

PUERTO BARRIOS AND LIVINGSTON.

The places first visited for the purpose of making mycological collections in 1905 and 1906 were Puerto Barrios and Livingston on the Atlantic coast, that is to say on the Honduras Bay. Immediately back of the low mangrove-skirted coast at Puerto Barrios lies an extensive tropical swamp, covered by impenetrable vegetation of ferns, palms, lianes and large trees. The Northern Railroad running southward for a distance from the coast, has opened up a line through this interesting tract and collecting is thus abundantly facilitated. This rich tropical vegetation however did not furnish as many parasitic fungi as some other districts, though a fair amount of saprophytic species were noticed. The situation of Livingston, 12 miles north of Puerto Barrios, at the mouth of Rio Dulce, is wholly unlike the latter. The town is built on a rocky bluff 50 to 60 feet high fringed with shrubs and trees — the Cocoanut-palm everywhere planted in the low country being a conspicuous feature of the landscape. A small area outside of the town has been cleared — which affords opportunity for "weeds" — native and introduced — and thus a marked variation is noticeable from the dense jungle of tree-ferns, palms, hosts of *Melastomaceae,* climbing Panicums and numerous other interesting forms most of which are hosts to parasitic fungi.

TENADORES AND LOS AMATES.

At the point where the railroad touches the Rio Motagua the little village of Tenadores is situated in the midst of extensive Banana fields. Small clearings around have been made. The river is fringed with great areas of tall canes and grasses. The great Monaca Palm is everywhere conspicuous as also is the *Ceiba* [pron. say-eé-bah] the latter in many cases being of enormous size. A somewhat better mycological field for the collector is offered at Los Amates, a town on the Rio Motagua about 60 miles from the Port. The altitude is 160 feet; the river valley is wide and covered with a varied growth of plants. Northward a few miles the low mountain range of Sierra del Mico is encountered. Somewhat varied edaphic conditions are afforded and the region is a very rich one for the collector. A short distance above the town are some extensive pampas regions and further up the river are denuded forest areas formerly covered with Pines (Pinus caribaea) now turned into lumber and exported.

GUALAN AND ZACAPA.

On the Rio Motagua 80 miles from the Port (Barrios) is situated the Indian city of Gualân at which point the central semi-arid or desert region begins. Cactus trees of the *Cereus, Opuntia* and *Peireskia* types occur, but not in great abundance. Numerous other xerophytic plans occur in this region, which therefore is extremely interesting and rich in parasitic fungi. It is just beyond the very moist low country. The altitude is 420 feet. The valley proper varies from one mile to three or four times that width. The Sierra de las Minas range lies immediately to the north and hills or low mountains flank the southern side. At present this is the end of the first division of the Northern Railroad (Ferro-carril del Norte), and the location of the shops and offices — all of which however are to be moved immediately to Zacapa a town 20 miles farther up the river situated in the wider valley of the Zacapa River, a branch of the Motagua. Before passing, it is a pleasure to acknowledg the kindly assistance in our work afforded by Mr. G. F. Williamson the Manager of the Railroad. In his absence his first assistant Mr. Fox was equally polite and obliging to us. At Zacapa the vegetation has a more pronounced xerophytic type — the tree Cacti are more numerous, and the great wastes of Acacia and Mimosa bushes are impressive. Grasses are very numerous — in wet places tall forms occur, but over the dry areas short-stemmed species form a sparse layer, yet almost dense enough to be called sod. The mountains become gradually higher more sharply limiting the narrowing valley till El Rancho is reached.

EL RANCHO.

This place for years the terminus of the Northern Railroad, 130 miles from Puerto Barrios and almost half-way across the continent in an E. N. E. and W. S. W. line, is an interesting region to the traveler as well as to the botanist. The Sierra de las Minas immediately to the north lifts its peaks into the clouds, attaining an altitude of about 3,000 feet. The mountains to the south of the narrow valley are of insignificant height. The great river Motagua even at this dry winter season demands care from those who ford its waters. But the chief charm is in the peculiar vegetation — the numerous *Peireskiae* (Cacti) with leaves still attached or wholly discarded, in all cases loaded with the pomiform fruits suggesting at a short distance a real apple orchard; the giant Cereus trees and the equally abundant and striking Opuntias and their near relatives; the Ficus trees; the common Bastard Mahogany, the real Mahogany, the hosts of leguminosae and other thorny trees, — and yet other xerophytic forms too numerous to mention suggests the field afforded the exploring mycologist, making the sojourn at once a place extremely interesting and equally profitable. This semi-desert region extends still farther up the Motagua and again north westward to Salamá into regions to be explored on a future trip. From this place our route took a west southwesterly course passing through Sanarate, an important town of considerable altitude, across the rugged San Antonio Mountain by a rocky trail, by way of Agua Caliente, to the city of Guatemala.

GUATEMALA CITY.

At an altitude of about 5,000 feet the city of Guatamala is situated on a mesa surrounded by deep barrancas beyond which are mountains whose summits are 500 to 1,000 feet above the plateau. It is a beautiful site but no detailed account of the vegetation of the region need be given. That of the higher mountains is somewhat peculiar. Forests of pines are not uncommon. Intermediate between these but at very high altitudes the oaks are very numerous. The *Compositae,* the herbaceous, the half-shrubby, the fruiticose and arborescent forms, are abundant here as throughout the Republic. Labiatae are perhaps more abundant than in the very low country. The *Leguminosae* are conspicuous by their abundance and in this respect rival the *Compositae.* The arboreous species are common. Rusts were everywhere in evidence, and in fact the parasitic species of all groups of fungi were numerously represented. In the rainy season the saprophytic forms could doubtless be collected in great abundance.

PACIFIC COAST REGION.

The Central Railroad leads by a serpentine route 74 miles from Guatemala City to San José, a Pacific port 40 or 50 miles distant, the descent in this short distance being about 5,000 feet. Through the thoughtful courtesy of Mr. D. B. Hodgson, (Gen. Mgr.), and Mr. W. B. Tisdal, (Asst. Mgr.), facilities were kindly offered for transportation, including scientific paraphernalia, along this line and their yet more interesting western branch that parallels the coast at a distance of about 40 miles — this being a finished portion of the Pan-American Railway — traversing an exceedingly rich country at the foot of the Cordilleras, ending at present at the large city of Mazatenango. Still another Company operates a Railroad from the latter city to Ratalhuleu, thence southwrd to the Pacific Port of Champerico and northward to San Felipe. This whole region is extremely warm; the vegetation is dense and tropical, but very much extended areas have been cleared and now furnish splendid fields for sugar cane. Lagoons border the coast which is fringed as in all tropical regions with the Mangrove. The whole country is a paradise for the botanist, and fungi are everywhere plentiful enough. Large collections for future study were made at Escuintla, Santa Lucia, Patalúl and Mazatenango. From this region two trips were made northward to the crest of the Cordilleras to several interesting points as follows.

QUEZALTENANGO.

From San Felipe in the northern part of the Department of Retalhuleu, altitude 1,050 feet, a trip was made mule-back, between 20 and 30 miles to Quezaltenango in the Department of like name, altitude 8,000 feet. For a large part of the way the vegetation was tropical and the region was enchanting. Splendid coffee planatations were passed, and higher up vegetation, characteristic of mountainous regions, was encountered. Abundant collections were made. The trip to Lake Atitlán was made from Patalúl which proved to be a charming repetition in the main of the route before described to Quezaltenango. This may be described in connection with another considerable mountain-lake, namely Amatitlán.

LAKES ATITLAN AND AMATITLAN.

Besides the great Lake Izabal near the east coast in Department of same name and Lake San André or Petén in the middle of the Department of El Petén — neither included in the itinerary of 1905 and 1906 — the only other very large bodies of water in the interior of Guatemala are the mountain lakes of Amatitlán, in the Department of same name, and Atitlán, in the Department of Solalá. These lakes are 7 or 8 miles in length; Atitlán is 6 or 7 miles wide, but Amatitlán has a width of only one mile near the middle and about 3 miles exclusive of this narrow neck. They are alike in having for the most part walls of rather steep sloping mountains — yet the flat area on the north side of Amatitlán is very great — being the debris of ages brought down by the drainage from the north, finding its way into this mountain-hemmed basin mainly through the river emptying in the Lake at the middle and now greatly narrowed part. There is no visible outlet to Lake Atitlán; Rio Michatoya drains Lake Amatitlán Pacific-ward. This lake is only about one hundred feet deep, but some parts of Lake Atitlán are over 1,000 feet in depth. Much time was spent on Lake Amatitlán to which then the following more particularly applies. The marked xerophytic character of the shore vegetation, as well as that of the slopes, was striking. Cacti were rather abundant; Acaciae and Mimosae were common; the Agaves were not rare; and hosts of *Compositae, Leguminosae, Labiatae,* etc., were present. One species of fleshy Asclepias grew on the shore; some species of Ficus were common; a giant Equisetum was encountered; groves of Salix humboldtiana were conspicuous; and epiphytic orchids, cacti, and bromeliads abounded. The parasitic fungi in due quantity were at hand and later reports will show that many species were here collected.

THE VOLCANOES AGUA, ATITLAN AND SANTA MARIA.

Collections were made on three of the very high volcanoes, namely Agua, Atitlán and Santa Maria, also on Cerro Quemado and the lower part of Acatenango. The altitudes of the first three are 12,300, 11,500 and 11,360 feet respectively. Agua, situated in the Department Sacatepéquez, is clothed with vegetation to the very apex and on the interior of the rather small crater — coarse grasses, some shrubs and a few stunted trees. A heavy belt of timber encircles the cone reaching a line within perhaps 2,000 feet of the apex. Toward the base it has been denuded of the original vegetation and converted into farms. Clouds and mists keep the upper portion bathed in moisture and the vegetation is very luxuriant except near the top. The entire area of its flanks furnishes excellent opportunity for the botanical collector. The volcano Atitlán is in the Department of Solalá immediately south of Lake Atitlán, and in general appearance is much like Agua. It is not however clothed with vegetation to the extreme apex — the volcanic ash preventing plants from getting a foothold there. The forest covering which is very dense, beginning immediately below the line of loose material, has not been disturbed except very near the base. The volcano Santa Maria in the Department of Quezaltenango is likewise clothed with forest vegetation, which reaches the summit. The eruption that took place in 1902 completely destroyed the vegetation on the south and southwest side where a new crater of immense size was formed. Many parasitic fungi were obtained on these volcanoes, especially on the first named in the list, yet the collections must be materially augmented by future trips before a just estimate can be made as to abundance, distribution and character.

ACKNOWLEDGEMENTS.

By no means so much could have been accomplished without the cordial assistance and encouragement of many residents and citizens of that Republic. First of all thanks are due the officers of the Northern Railroad (Ferro-carril del Norte), and of the Central Railroad (Ferro-carril Central de Guatemala), for courtesies, previously mentioned in this article. The American Minister Plenipotentiary Mr. Combs, the Consul General Mr. Winslow, the Vice Consul Mr. Owen, and Rev. W. B. Allison a resident missionary, also assisted by kindly advice; the pleasures of the trip were greatly enhanced by the courteous and cordial reception by their families. It is a pleasure also to acknowledge the uniform courtesy of the officers of the Republic, and their interest in our explorations, which is at the same time a reflection of the liberal and advanced policy, and deep interest in scientific and industrial advancement, on the part of the President of Guatemala, Manuel Estrada Cabrera.

OCCURRENCE OF LASIODIPLODIA ON THEOBROMA CACAO AND MANGIFERA INDICA.

VERA K. CHARLES.

In the spring of the present year a consignment of diseased Theobroma material, which included wood and fruit was sent